Brief To:

National Defense Industrial Association
Systems Engineering Conference

'Real' T&E and the 'Virtual' Missile Range

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Mr. Norm Nguyen, VMR Program Mgr.
NAVAIR-WD, Code 525110E
Point Mugu, CA 93042
(805) 989-3043, DSN 351-3043
nguyennv@navair.navy.mil

Mr. Tom Rozanski, VMR Systems Egr.
NAVAIR-WD, Code 4KED00E
Point Mugu, CA 93042
(805) 989-0347, DSN 351-0347
rozanskitj@navair.navy.mil
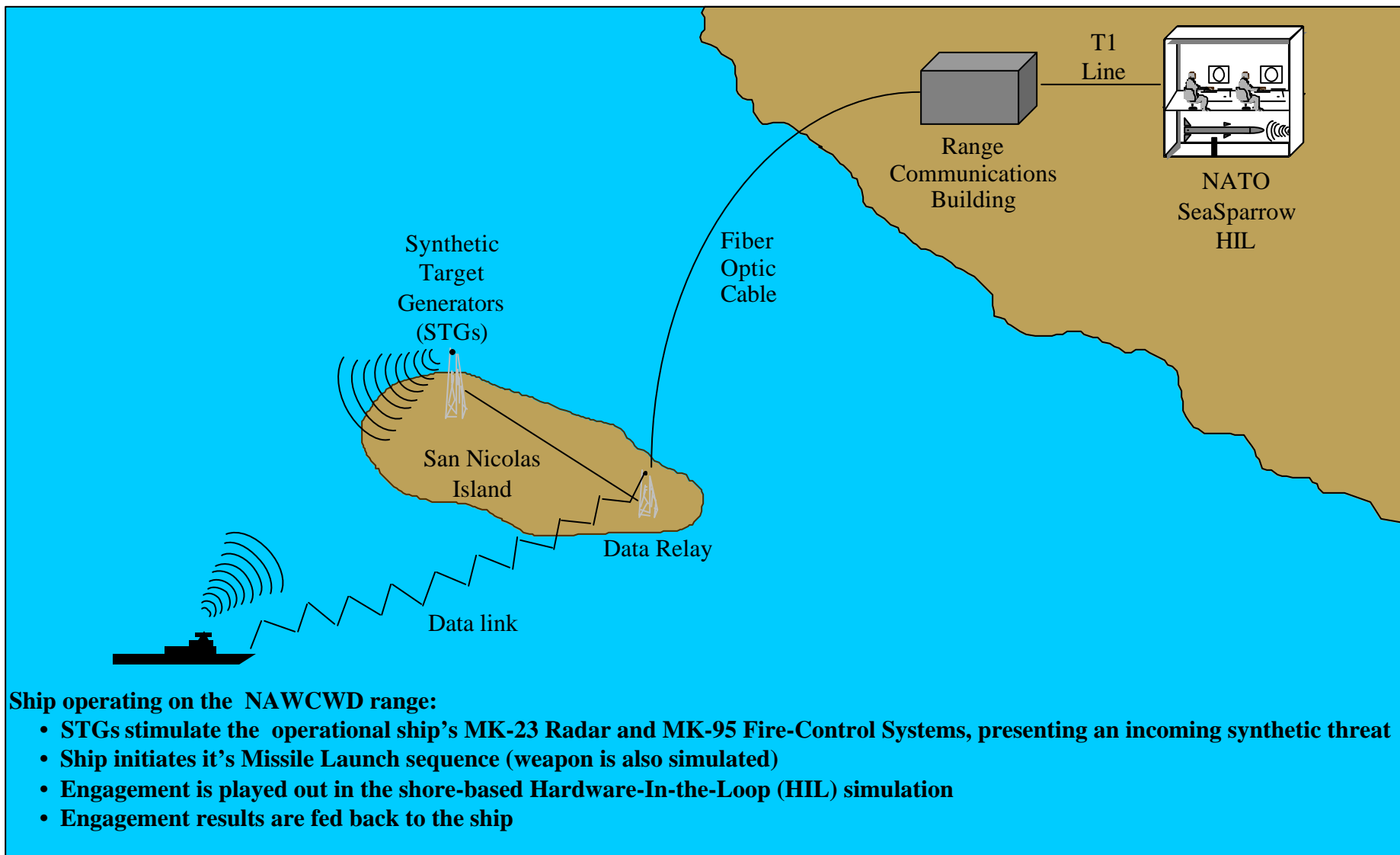
TEST AND EVALUATION ENGINEERING. AIR-4.11

Theme

Early, Sequential, Systems T&E,
Allowed the
'Virtual' Missile Range
To Become a 'Reality.'

Outline

- VMR Vision

- Early T&E Components & Opportunities

- Sequential T&E

- Systems T&E

- Operational Implementation & Results

- Next Steps

Vision & Operational End-State

Ship operating on the NAWCWD range:
- **STGs stimulate the operational ship's MK-23 Radar and MK-95 Fire-Control Systems, presenting an incoming synthetic threat**
- **Ship initiates it's Missile Launch sequence (weapon is also simulated)**
- **Engagement is played out in the shore-based Hardware-In-the-Loop (HIL) simulation**
- **Engagement results are fed back to the ship**
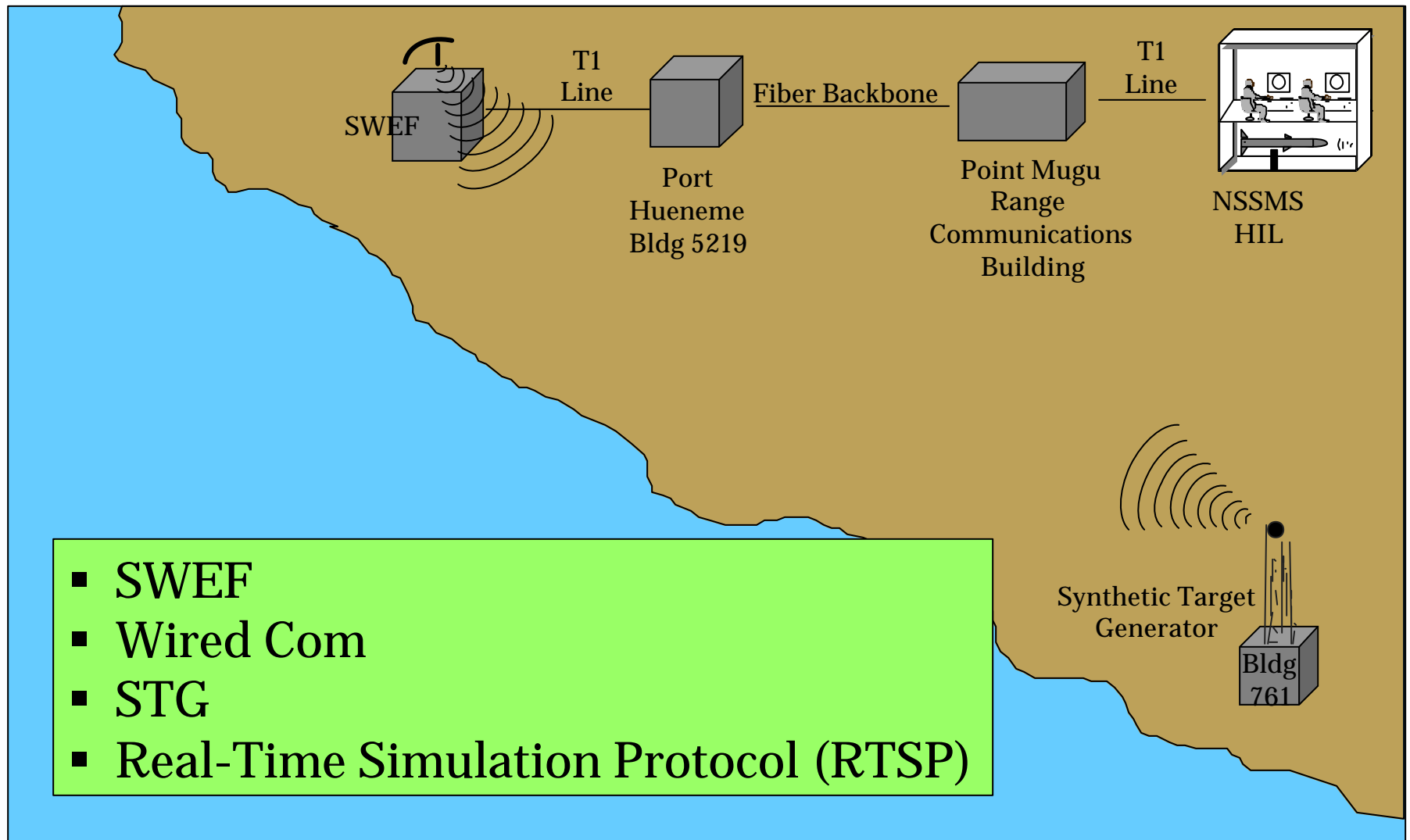
Surface Warfare Engineering Facility

Target Acquisition System (MK-23)

NATO Sea Sparrow Fire Control Radar (MK-95)

NATO SeaSparrow Missile Launcher
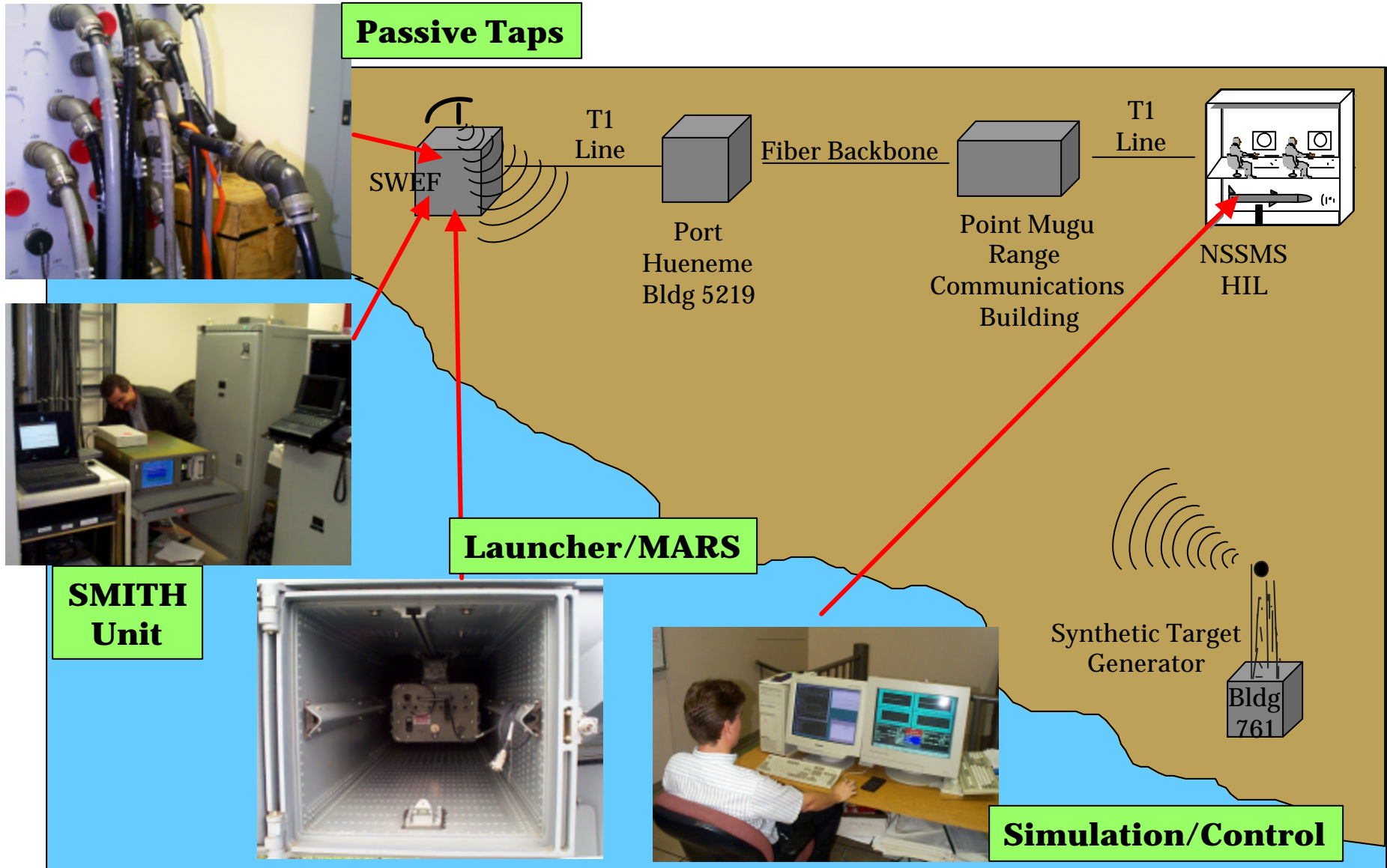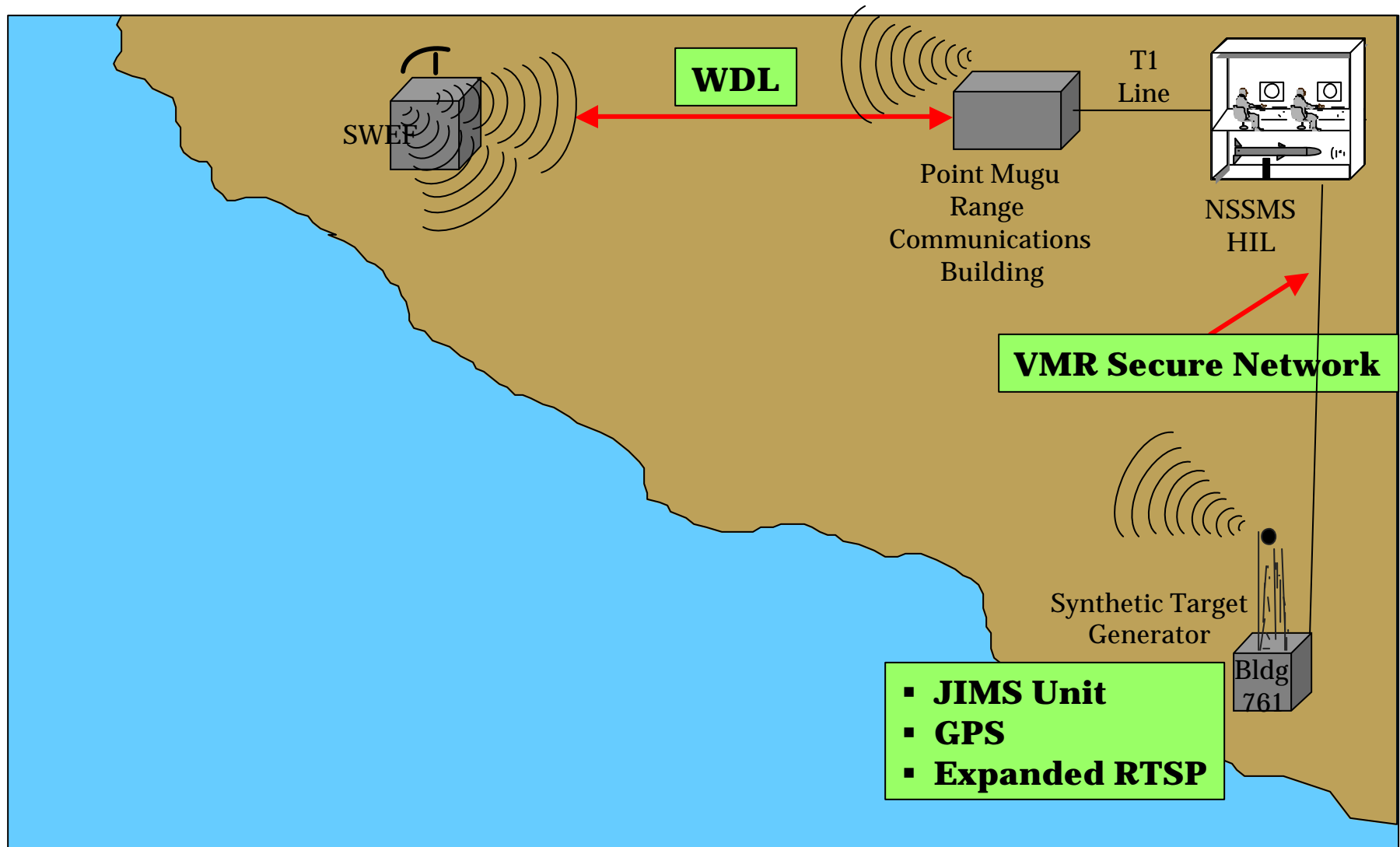
Land-Based T&E, Phase 1

SWEF

T1 Line

Port Hueneme Bldg 5219

Fiber Backbone

Point Mugu Range Communications Building

T1 Line

NSSMS HIL

Synthetic Target Generator

Bldg 761

- SWEF
- Wired Com
- STG
- Real-Time Simulation Protocol (RTSP)

Land-Based T&E, Phase 2

Passive Taps

SWEF

T1 Line

Port Hueneme Bldg 5219

Fiber Backbone

Point Mugu Range Communications Building

T1 Line

NSSMS HIL

SMITH Unit

Launcher/MARS

Synthetic Target Generator

Bldg 761

Simulation/Control

NAV AIR
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Land-Based T&E, Phase 3

WDL

SWEF

T1 Line

Point Mugu Range Communications Building

NSSMS HIL

VMR Secure Network

Synthetic Target Generator

Bldg 761

- JIMS Unit
- GPS
- Expanded RTSP

NAVAIR

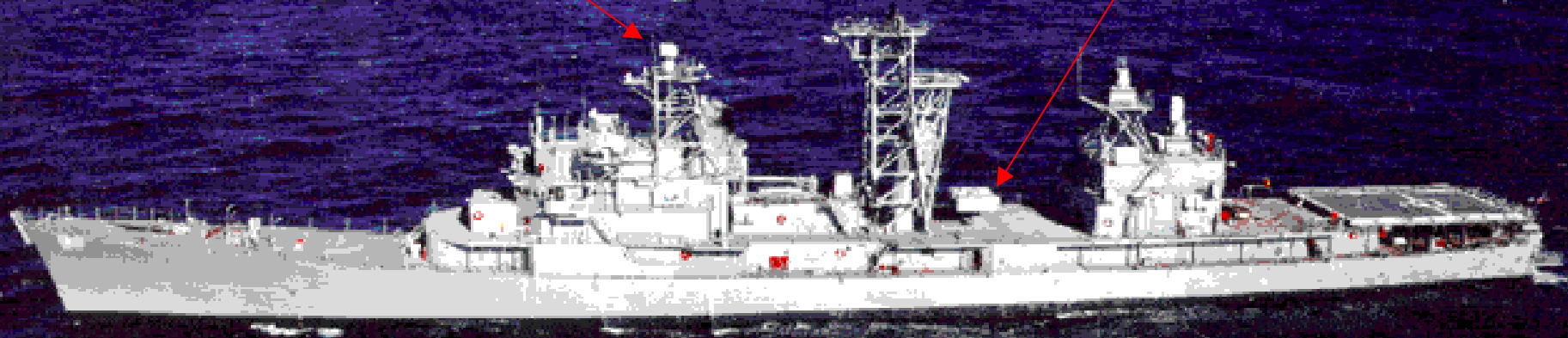TEST AND EVALUATION ENGINEERING, AIR-4.11

Self Defense Test Ship

Target Acquisition System (MK-23)

NSSM Launcher

NATO SEASPARROW Missile System (MK-95)

Ship Installs

- **Data Acquisition**
  - Synthetic Missile Interface Terminal H/W (SMITH) Unit
    - o Pre-Launch Signals
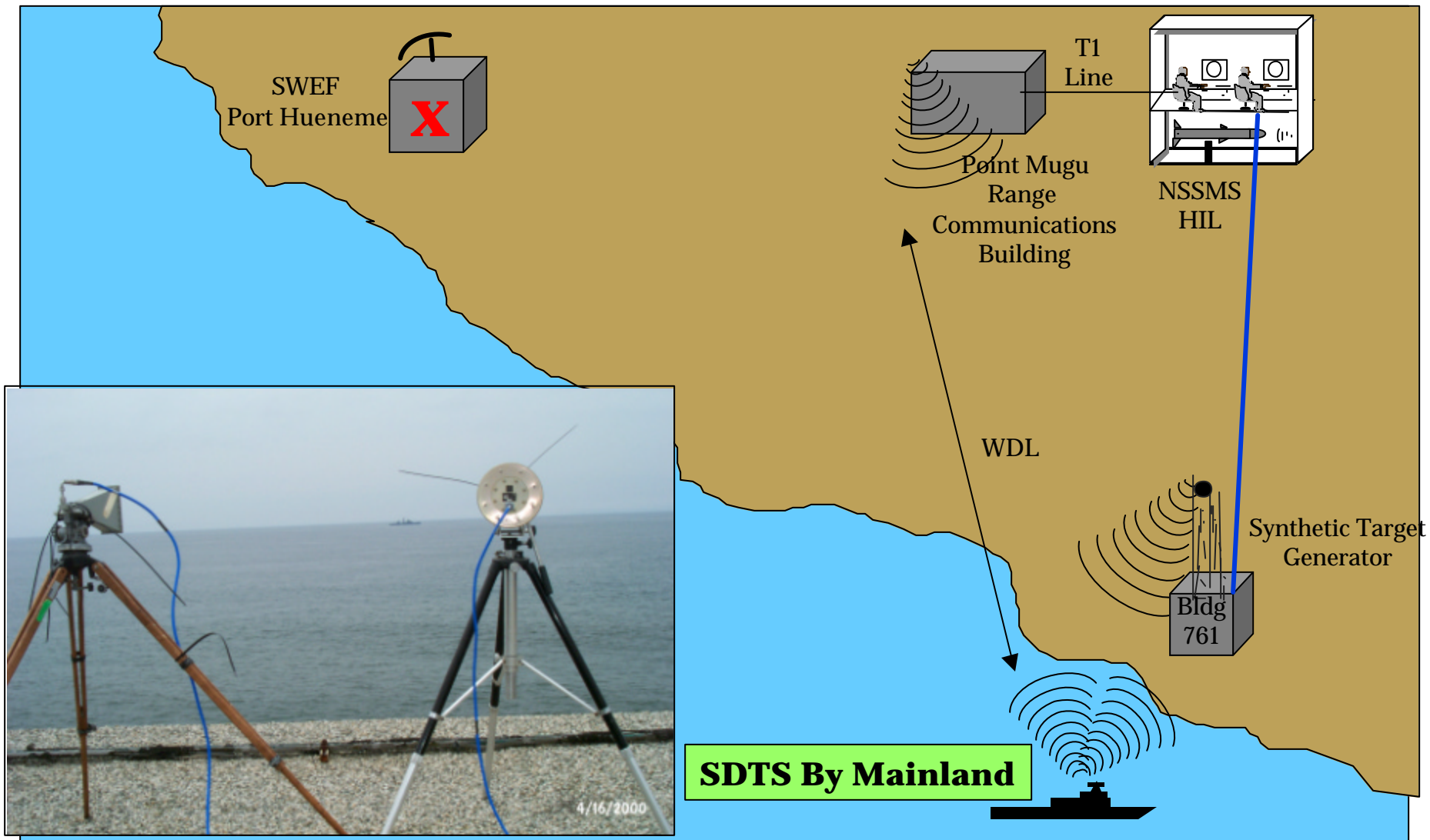 - Break-Out Cables & Extensions
  - GPS Antenna

- **Wireless Data Link**
  - Base Station, Antenna, Crypto
  - 2.4 GHz From Ship To Island

- **Missile All-up Round Simulator (MARS)**
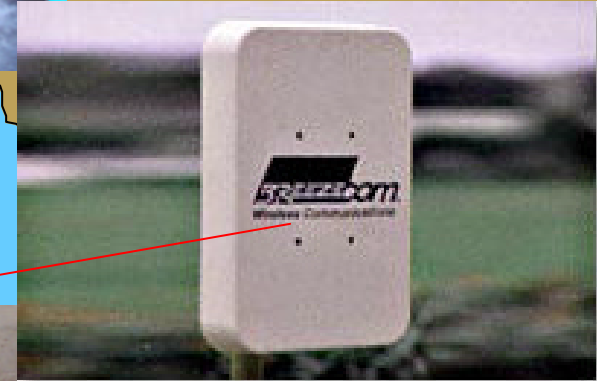 - Simulates RIM-7P Missile Within Launcher

Sea-Based T&E, Phase 1

SWEF
Port Hueneme

X

T1
Line

Point Mugu
Range
Communications
Building

NSSMS
HIL

WDL

Synthetic Target
Generator

Bldg
761

SDTS By Mainland

4/16/2000

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Moved to San Nicolas Island

Synthetic Target Generators (STGs)

STG Radomes

JIMS GPS

STG Electronics Room

San Nicolas Island

WDL Antenna

Data Relay Point

SNI Comm Bldg.

Sea-Based T&E, Phase 2

T1 Line

Range Communications Building

NATO SeaSparrow HIL

Synthetic Target Generators (STGs)

Fiber Optic Cable

- **SMITH Unit**
- **WDL**
- **MARS Unit**
- **GPS**
- **Crypto**

San Nicolas Island

Data Relay

Data link

SDTS on the NAWCWD range:

NAV AIR

TEST AND EVALUATION ENGINEERING, AIR-4.11
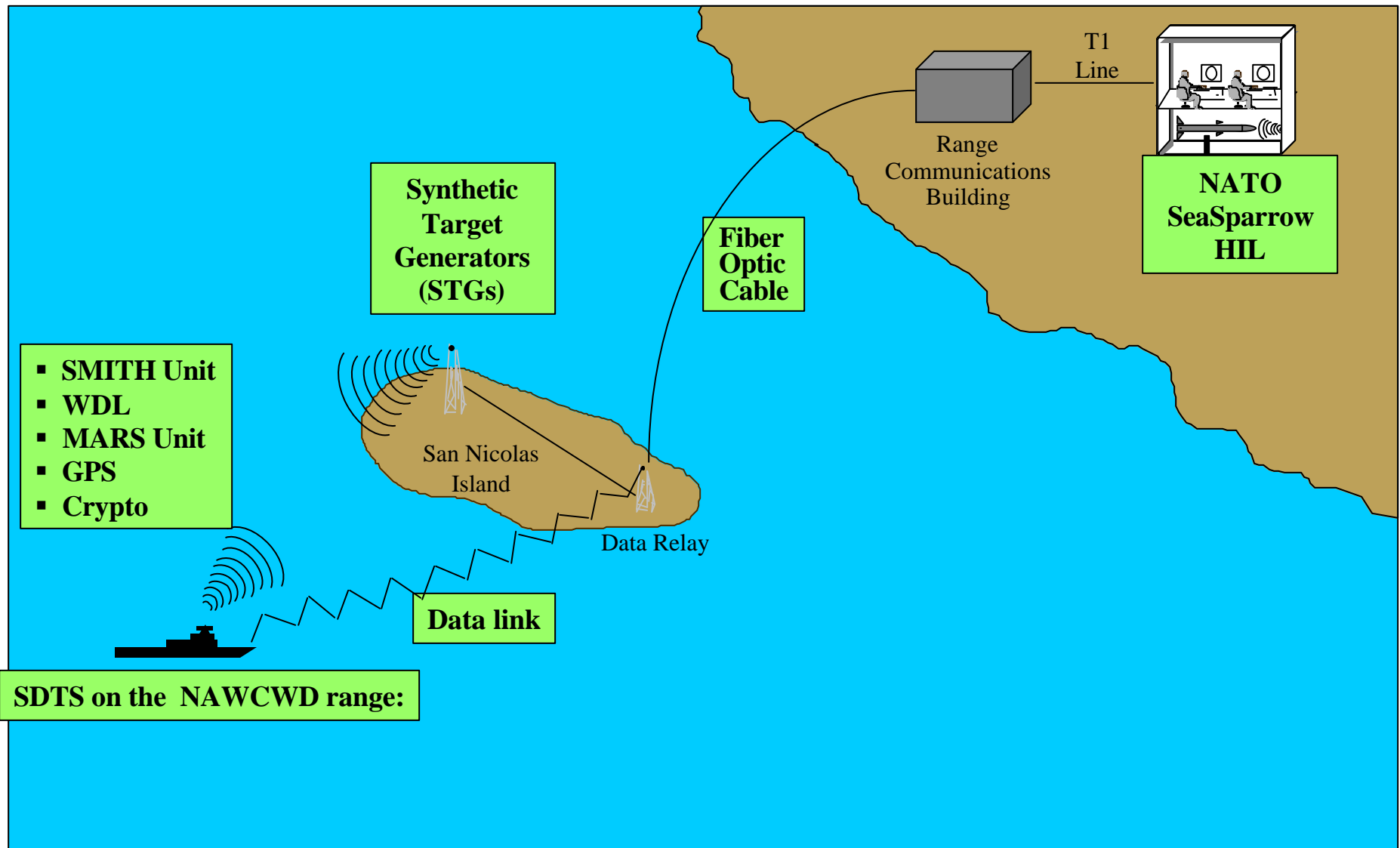
USS Kinkaid Operation

Interoperability Test and Evaluation Center (ITEC)

NSSM Firing Consoles
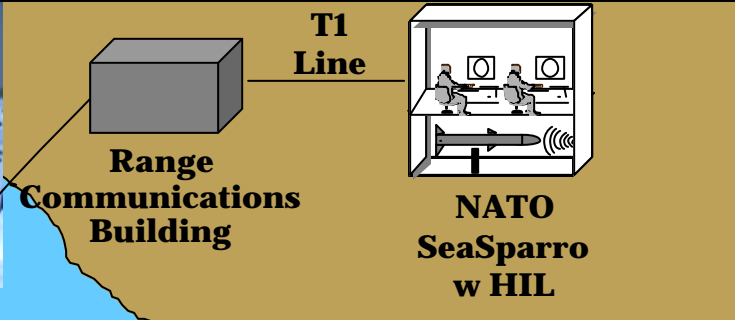
Synthetic Target Generators (STGs)

San Nicolas Island

Data Relay

Data link

Range Communications Building

T1 Line

NATO SeaSparro w HIL

Fiber Optic Cable

USS KINKAID

STEADFAST AND TRUE

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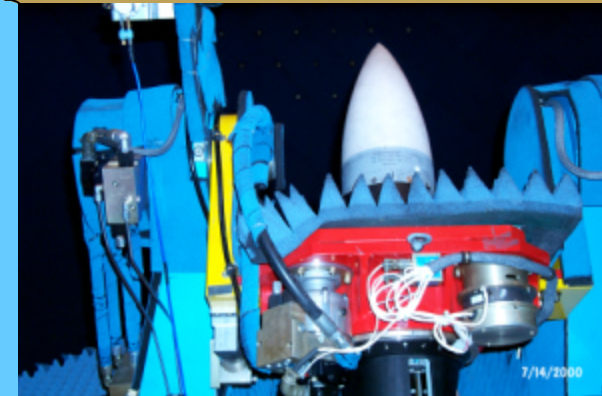
Results

12 Sept '00

- 49 Incoming Threats Presented
- 6 Different Start Ranges, Speeds, RCSs
- 3 Firing Crews Cycled Through Consoles

13 Sept '00

- 37 Incoming Threats Presented
- 5 Different Start Ranges, Speeds, RCSs
- 6 Launches / 4 Kills

Summary

- **Early, Sequential, Systems T&E Accomplished**
- **Initial Attempt in Operational Conditions was Successful**
- **VMR:**
  - **Increases Use of Modeling & Simulation**
  - **Integrates T&E and Training**
 - **Lowers T&E and Training Costs**

Next Steps

- **Electronic CounterMeasures**
  - Generic Jamming (Now Operational)
  - Threat Replica Jamming
- **Additional Threat Presentations**
  - Multi Axis
  - Stream Raid
  - Maneuvering
- **Additional Platforms**
  - CV, AO
  - AEGIS (Operational FY-04)
- **Additional Missiles**
  - VL NSSM, ESSM, SM

Back-Up Slides

Hardware-In-the-Loop (HIL) Lab(s)

- **Major Components**
  - **Missile guidance system on a 3-axis motion table**
  - **Anechoic chamber with target array**
  - **High performance, real-time computer system**

- **RF Signals Simulate:**
  - **Target skin returns**
  - **Sea clutter**
  - **Sea image**
  - **Electronic Countermeasures**
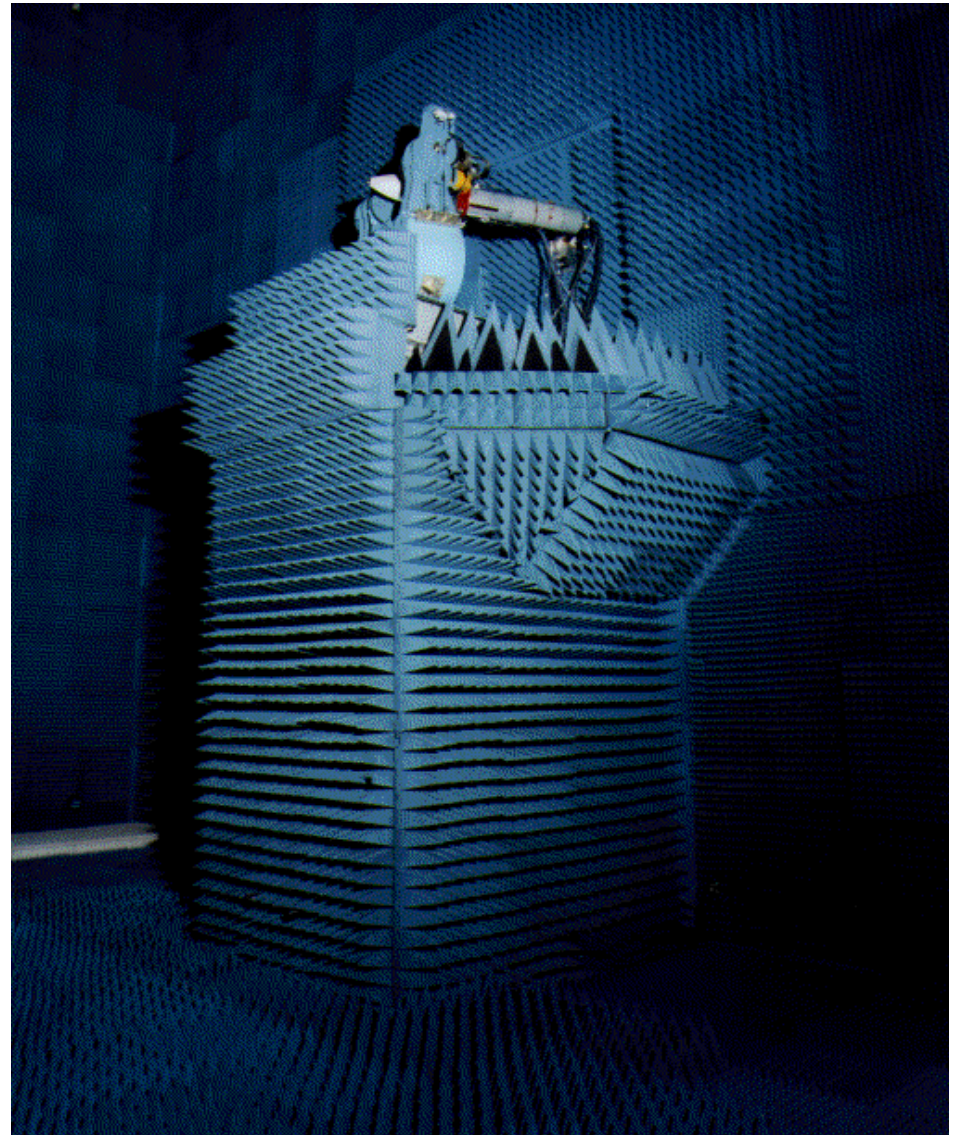
Threat Simulation

- **Tri-Service Lead**
  - This lead includes all EA and radar signal simulators used in targets
- **Goal**
  - Develop, deploy, and support EW threat simulation equipment that provides realistic threat radar signals and threat electronic attack (EA) signals.
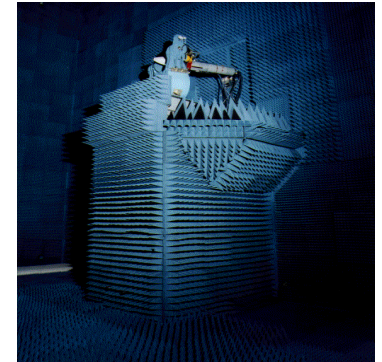

THE ART OF DECEPTION

THREAT SYSTEMS
PT. MUGU, CALIFORNIA

Operational Costs

1 Event = About 2.5 hours (Estimated 25-shots)

Event Cost: About 10% of a 1-shot Event

Per Shot Cost: About 1% of a 1-shot Event

(Based on a 25-shot Event)

Realm Of The VMR

| Detect | Assess & Designate | Engage | Missile Flyout |

- External Target Gen
- TAS
- NSSMS Fire Control

← **Other Training Systems** →

- 6DOF/HIL Simulation
- STG Dispersion
- End Game/Lethality

← **VMR** →

← **Live Fire Test** →

- Sticky Accelerator
- Fuse Activation
- Propulsion
- Many Other Electro/ Mechanical Entities